



Space Expo

The 1995 Space Exploration conference drew crowds for several different discussions. Photo on Page 4.

Space News Roundup

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STS-73 Pilot Kent Rominger floats in the tunnel used to travel from the orbiter's middeck to the Spacelab science module in *Columbia's* payload bay. Rominger, along with his fellow crew members, will return home Sunday after setting a record for the second longest shuttle flight to date.

Scientists exult over Spacelab science results

By James Hartsfield

Columbia and a crew of seven continued to sail smoothly this week on what is expected to become the second longest shuttle flight ever.

The slate of investigations involving weightlessness, encompassing an array of studies ranging from fluid physics to materials science to biotechnology and combustion, has delighted scientists on the ground at Marshall Space Flight Center's Spacelab Operations Control Center. The rhythm of the United States Microgravity Laboratory work, with several new communications systems also being tested aboard *Columbia*, has provided a preview of planned operations aboard station.

The Red Team crew, made up of Commander Ken Bowersox, Pilot Kent Rominger, Payload Commander Kathy Thornton and Payload Specialist Al Sacco, and their Blue Team counterparts—Mission Specialists Mike Lopez-Alegria and Cady Coleman and Payload Specialist Fred Leslie—reported the pace of 12-hour work shifts onboard to be fairly routine as *Columbia* passed the halfway mark during the weekend.

"We feel like we're back home in the Payload Crew Training Complex," Coleman told scientists.

Columbia remains scheduled for a landing at 5:48 a.m. CST Sunday at Kennedy Space Center. The shuttle

has encountered very minor mechanical problems during the mission, with no interruptions to the ongoing science work, said mission operations representative Bob Castle.

Scientists have been following their experiments aboard *Columbia* using as many as six different simultaneous television views that can be sent to the ground via a new system called Hi-Pack TV. The insight already has provided glimpses of results.

In one study, called the Interface Configuration Experiment, investigator Mark Weislogel of the Lewis Research Center reported unexpected differences in the behavior of fluids as they filled special containers aboard *Columbia*, differences that

showed predictions of current mathematical models could be incorrect. "It showed that we cannot rely completely on the current theory of how surfaces form in low gravity," Weislogel said. "We saw that physical factors which are not included in the purely mathematical theory do play a significant role." The insight gained from the investigation may help in the design of future fluid systems for space, such as liquid fuel systems.

Another investigation, called Astroculture, has studied the growth of plants in space, with potato plants being grown in *Columbia's* lab. The

Please see **CREW**, Page 4



STS-74 launch date set

By Karen Schmidt

NASA managers set Nov. 11 as the official launch date for the second mission to dock with the Russian Space Station Mir.

The eight-day mission is scheduled for liftoff at 6:56 a.m. CST from Kennedy Space Center's Launch Complex 39-A. The actual time may vary due to Mir's precise location in space at the time of *Atlantis's* liftoff. The available launch window for *Atlantis* is about seven minutes.

Commander Ken Cameron, Pilot Jim Halsell, and Mission Specialists Jerry Ross, Bill McArthur and Chris Hadfield will rendezvous with the Mir to install a permanent docking module to improve clearance between Mir's solar arrays for future dockings.



"We are looking forward to carrying out what I think will be an extremely interesting mission," Cameron said during a preflight briefing held last week. "STS-74 has a very international element. There will be representatives from four of the major partners of the International Space Station with the exception of Japan. We'll be doing some work which is a precursor to the assembly of the International Space Station."

During the first day in orbit, Cameron and Halsell will power the module to provide active thermal control.

"Before we can dock with Mir, we need to assemble the docking module in the payload bay of the shuttle," Hadfield said. "I'll be using the robot arm on day three to

Please see **LASERS**, Page 4

Test results show Galileo tape recorder back on track

NASA's Galileo spacecraft is proceeding toward its December rendezvous with Jupiter and engineers are relieved at test results showing that its tape recorder is functioning.

On Oct. 24, a revised spacecraft command sequence radioed to Galileo began issuing instructions ordering the spacecraft to resume regular readouts of data from the memories of several science instruments. The spacecraft also returned to normal housekeeping duties, executing scheduled engineering operations such as flushing of rocket thrusters.

The new command sequence replaced the one ground controllers stopped after the Oct. 11 tape recorder problem, in which the data tape recorder failed to cease rewinding after recording an image of Jupiter.

The tape recorder had remained in a stand-by mode until Oct. 20, when it was tested and proved still operational. Detailed study of data from the spacecraft indicates that the tape recorder can be unreliable under some operating conditions, project officials said. However, the problem appears to be manageable, and should not jeopardize return of the nearly 2,000 images of Jupiter and its moons.

Work on the spacecraft included commands for the recorder to wind 25 extra times around a section of tape possibly weakened when the recorder was stuck in rewind mode with the tape immobilized for about 15 hours.

Due to uncertainty about its condition, engineers have declared that this portion near the end of the tape reel is "off-limits" for future

data recording. The extra tape wound over it secures that area of tape, eliminating any stresses that could tear the tape. With only weeks to go before Galileo's Dec. 7 arrival at Jupiter, project engineers are busy analyzing the recorder's condition to fully understand its capabilities and weaknesses.

"We need to be sure we fully understand the system that we have now," said Galileo Project Manager William O'Neil.

The recorder is a key link to compensate for the loss of Galileo's high-gain antenna, which is stuck in a partially open position. Data must now be sent at a much lower rate. The tape recorder is to be used to store information until it can be compressed and edited by spacecraft computers and radioed back.

Since the tape recorder incident, Galileo project officials have decided not to take pictures of Io and Europa on the day the spacecraft arrives at Jupiter. Instead, they will devote the tape recorder that day to gathering data from Galileo's Jupiter atmospheric probe as the cone-shaped probe descends into the giant planet's swirling atmosphere over the course of its 75-minute mission. During that time, the probe will collect the first-ever direct measurements of the chemical makeup and weather of the solar system's largest planet.

"Our priorities are clear," said O'Neil. "We have to get all the probe data." Other flybys of the Jovian moons, including frequent "volcano watch" monitoring of Io, occur throughout the mission, giving opportunity to collect data.

Rockets receive orbital uniform

The astronauts who slam-dunked the STS-71 shuttle-Mir docking mission made a behind the back pass to the two-time NBA World Champion Houston Rockets on Monday, delivering a new Rockets uniform that had made the ultimate vertical leap.

Rockets superstar guard Clyde Drexler accepted the uniform on behalf of the team in a ceremony at Space Center Houston.

Richard Allen, president and general manager of Space Center Houston introduced the STS-71 members—Commander Hoot Gibson, Mission Specialist Bonnie Dunbar and Astronaut/Research Norm Thagard—to the audience and asked Gibson to make the special presentation.

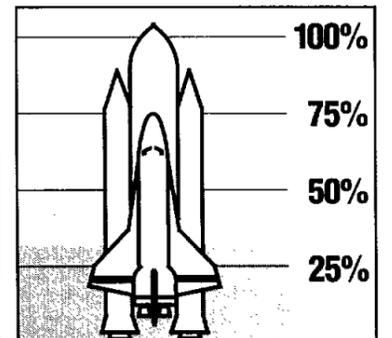
"We are celebrating teamwork on many different fronts," Gibson said. "We have a really spectacular team here in Houston

namely, our very own Houston Rockets. We are here today to pay tribute to the Rockets and to help say in our own way how much we appreciate them."

Gibson, along with Dunbar and Thagard, read the certificate of authenticity and presented the uniform to Drexler letting him know that they took very good care of the uniform during the flight. "On behalf of the Houston Rockets organization and myself, I would like to say thank you for this fantastic honor," Drexler said. "As you continue to pioneer the last frontier, space, we are deeply honored to have been a part of this mission. The uniform is in great shape. We have an awful lot of respect for the things that you guys do. Like you said Hoot, two great organizations setting their goals at the top and getting results, that's what it's all about."



Astronaut Hoot Gibson, left, presents Clyde Drexler his uniform that was flown on *Atlantis*. Gibson presented the uniform with the help of Astronauts Norm Thagard and Bonnie Dunbar.



1995 GOAL: \$460,000



JSC

Ticket Window

The following discount tickets are available for purchase in the Bldg. 11 Exchange Store from 10 a.m.-2 p.m. Monday-Thursday and 9 a.m.-3 p.m. Friday. For more information, call x35350 or x30990.

Dickens on the Strand: Dec. 2 and 3. Tickets cost \$6.30.

Texas Renaissance Festival: Sept. 30-Nov. 12. Tickets cost \$10.50 for adults and \$5.25 for children 5-12.

Texas Renaissance Festival Bus Trip: Nov. 11. Tickets cost \$17 for adults and \$12 for children 5-12.

Houston Aeros Hockey: Houston Aeros vs. Atlanta Knights at 7 p.m. Nov. 17 in the Summit. Tickets cost \$12.50.

Sea World: Tickets cost \$23.50 for adults and \$16.25 for children 3-11.

Space Center Houston: Discount tickets, adult, \$8.75; child (3-11), \$7.10.

Metro tickets: Passes, books and single tickets available.

Movie discounts: General Cinema, \$4.75; AMC Theater, \$4; Sony Loew's Theater, \$4.75.

Stamps: Book of 20, \$6.40.

Sweetwater Pecans: \$5.60 per bag.

JSC history: *Suddenly, Tomorrow Came: A History of the Johnson Space Center.* Cost is \$11.

JSC

Gilruth Center News

Sign up policy: All classes and athletic activities are first come, first served. Sign up in person at the Gilruth Center and show a NASA badge or yellow EAA dependent badge. Classes tend to fill up two weeks in advance. Payment must be made in full, in exact change or by check, at the time of registration. No registration will be taken by telephone. For more information, call x30304.

EAA badges: Dependents and spouses may apply for photo identification badges from 7 a.m.-9 p.m. Monday-Friday; and 8 a.m.-4 p.m. Saturdays. Dependents must be between 16 and 23 years old.

Winter softball league: Teams interested in playing call the Gilruth at x33345.

Aerobics: Classes meet 5:15-6:15 p.m. Tuesday, Thursday and Friday and 9:30-11 a.m. Saturdays. Cost is \$35 for 11 weeks.

Women's self defense: Martial Arts training for women only from 5-6 p.m. Tuesdays and Wednesdays. Cost is \$25 a month.

Weight safety: Required course for employees wishing to use the weight room is offered from 8-9:30 p.m. Nov. 14 and Nov. 30. Pre-registration is required. Cost is \$5.

Exercise: Low-impact class meets from 5:15-6:15 p.m. Mondays and Wednesdays.

Aikido: Martial arts class meets from 5-7 p.m. Wednesday. Cost is \$25 per month. New classes begin the first of each month.

Ballroom dancing: Cost is \$60 per couple. For additional information call the Gilruth Center at x33345.

Country and Western dancing: Beginner class meets 7-8:30 p.m. Monday. Advance class meets 8:30-10 p.m. Monday. Cost is \$20 per couple.

Fitness program: Health Related Fitness Program includes a medical examination screening and a 12-week individually prescribed exercise program. For more information, call Larry Wier at x30301.

JSC

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Dates & Data

Today

Small Business Expo: Small, disadvantaged, and women-owned businesses may discuss their companies' capabilities with JSC's technical and procurement organizations, as well as major support contractors at an upcoming Small Business Expo to be held from 9 a.m.-2 p.m. Nov. 3 at the Gilruth Center. The free expo will offer briefings including ISO 9000—The NASA Plan; Mentor-Protégé Pilot Program; Doing Business with NASA; Setting Up a Basic Accounting System for Government Contracting; and an Introduction to Internet—The New Path to NASA Procurements. For more information, contact Barbara Kirkland at X34512.

Cafeteria menu — Special: fried chicken. Total Health: vegetable lasagna. Entrees: pollock hollandaise, beef stroganoff, vegetable lasagna. Vegetables: steamed broccoli, carrots vichy, Italian zucchini, breaded okra.

Monday

Cafeteria menu — Special: meat sauce and spaghetti. Total Health: potato baked chicken breast. Entrees: wieners and beans, sweet and sour pork chop, potato baked chicken, steamed fish, French dip sandwich. Soup: cream of broccoli. Vegetables: French cut green beans, seasoned rice, California vegetables, buttered beans.

Tuesday

ABWA meet: The Clear Lake Area Chapter of the American Business Women's Association will meet at 5:30 p.m. Nov. 7 at Space Center Houston's Silver Moon Cafe. A Christmas auction will be held to benefit the Chapter's scholarship fund. Justice of the Peace Steve Phelps will serve as auctioneer. Tickets cost \$10 and include dinner. For more

information Nancy Gabriel 486-7840 or Cyndi Draughon 996-9058 for reservations.

Cafeteria menu — Special: smothered steak with dressing. Total Health: baked potato. Entrees: beef stew, liver and onions, shrimp Creole, baked chicken, fried cod fish, French dip sandwich. Soup: navy bean. Vegetables: steamed rice, seasoned cabbage, corn O'Brien, peas.

Wednesday

Toastmasters meet: The Space Land Toastmasters will meet at 7 a.m. Nov. 8 at House of Prayer Lutheran Church on Bay Area Blvd. For additional information, contact Elaine Trainor, x31034.

MAES meets: The Society of Mexican American Engineers and Scientists will meet at 11:30 a.m. Nov. 8 in the executive dining room in the Bldg. 3 cafeteria. For more information call Michael Ruiz at x38169.

SSFF meets: The Space Station Future Fighters will meet at noon Nov. 8 at the Freeman Memorial Library at 16602 Diana. For information call David Cochran at 335-0185.

Astronomy seminar: The JSC Astronomy Seminar will meet at noon Nov. 8 in Bldg. 31, Rm. 129. An open discussion meeting is planned. For more information, call Al Jackson at 333-7679.

Cycle club: The Space City Cycle Club will meet for a 25-mile ride beginning at 6 p.m. Nov. 8 at the University of Houston Clear Lake soccer field. For more information on this ride and weekend rides call Mike Prendergast at x45164.

Cafeteria menu — Special: salmon croquette. Total Health: baked potato. Entrees: roast pork, stir fry-baked perch, steamed fish, vegetable lasagna, Reuben sandwich. Soup: seafood gumbo. Vegetables: mustard greens, okra and tomatoes, veg-

etable sticks, lima beans.

Thursday

SSQ meets: The Society for Software Quality will meet at 5:30 p.m. Nov. 9 at the Ramada Kings Inn on NASA Road 1. A. A. Boyd will discuss "The Baldrige Experience." Tickets cost \$10 for members and \$14 for non-members. Reservations must be made by Nov. 6. For more information call Dot Royer at 335-5888.

Airplane club meets: The MSC Radio Control Airplane Club will meet at 7:30 p.m. Nov. 9 at the Clear Lake Park Community Bldg. For more information call Bill Langdoc at x35970.

Cafeteria menu — Special: stuffed cabbage rolls. Total Health: baked potato. Entrees: beef tacos, ham and lima beans, pork and beef egg rolls, steamed fish, catfish, French dip sandwich. Soup: beef and barley. Vegetables: Brussels sprouts, green beans, buttered squash, pinto beans.

Friday

Veterans Day: Most JSC offices will be closed in observance of the Veterans Day holiday.

Nov. 13

Health plan open season: The 1995 open season for enrolling in or changing health plans under the Federal Employees Health Benefits Program begins Nov. 13 and continues through Dec. 11. During this open season period, employees may change health plans, add or remove dependent coverage, or enroll for the first time. For more information, contact Employee Services at x32681.

Nov. 14

Photo club meets: The Bay Area Photo Club will meet at 7:30 p.m. Nov. 14 at the Faith Covenant Church. For more information call Kelly Prendergast at x37655.

Swap Shop

Swap Shop ads are accepted from current and retired NASA civil service employees and on-site contractor employees. Each ad must be submitted on a separate full-sized, revised JSC Form 1452. Deadline is 5 p.m. every Friday, two weeks before the desired date of publication. Ads may be run only once. Send ads to Roundup Swap Shop, Code AP2, or deliver them to the deposite box outside Rm. 181 in Bldg. 2. No phone or fax ads accepted.

Property

Sale/Lease: Townhouse Queens Court II, Nassau Bay, 3-2-5-2, \$975/mo or \$93.3k. Marilyn, 333-1700.

Sale: Clear Lake Forest, 4-2-5-2, glass walled den family room, FPL, w/hi ceiling, formals, new roof & paint/carpet/paper. 326-2307.

Sale: Taylor Lake Estates wooded lot 90' x 135', can finance, \$39.5k obo. Don, x38039 or 333-1751.

Sale: League City, Bayridge Subdivision, 3-2-2, cul-de-sac street, \$58k. James, 286-1934 or 335-2959.

Sale: South Shore Harbour, 5-3-5, elegant formals, open kitchen, custom features, brick, oversize lot, \$130's. 334-4651.

Sale: Alvin, 10 acs, cleaned & tiled, barn, located on major road, \$44.9k. x30737.

Sale: League City lot, 82'x130' on Marie off Texas, \$6.5k. 332-6616.

Sale: 130 cleared acs, 5 pastures, near Tyler, house, hay & horse barns, all amenities. 488-5058.

Rent: Nassau Bay, 4-2-2D, 1900 sq ft, formal living & dining, parquet floor in family room & breakfast nook, gas FPL, \$1050/mo + dep. Connie, 486-4000.

Sale/Trade: League City, Ellis Landing, 4-2-2, w/2 story dutch barn, I will take your house or condo in trade, \$97.9k. x41929 or 332-3775.

Rent: Galveston condo, furn, sleeps 6, Seawall Blvd & 61st ST, wknd/wkly/dly rates. Magdi Yassa, 333-4760 or 486-0788.

Rent: Beach house, ocean view, Galveston county, furnished, sleeps 10, wood burning FPL, cable TV, wknd/wkly rates. 486-1888.

Rent: Lake Travis cabin, private boat dock, central air/heat, fully equipped, sleeps 8, fall, \$550 wkly/\$120 dly. 474-4922.

Rent: Cancun Sunset Club, 1-2, sleeps 6, kitchen, jacuzzi, pool, boating avail, beach front, avail 11/18-11/25 or other wks, \$750/wk. Paul, x41063 or 338-4535.

Rent: South Lake Tahoe cabin, 3-2m modern kitchen, W/D, TV/VCR, microwave, short drive to casinos, skiing, sleeps, \$75/night, except holidays. x41065 or 326-2866.

Cars & Trucks

'88 BMW 325iS, super clean, black w/tan int, sunroof, PW/PS, AM/FM/cass, 85k mi, garage kept, \$11k obo. 549-7311.

'93 Dodge RAM PU ext cab, loaded, 360 V8, 2WD, camper shell, 29k mi, \$14.5k obo. x41065 or 326-2866.

'82 Pontiac Bonneville, tan/beige, A/C, P/W, AM/FM/cass, good cond, \$1.5k obo. Paula, x31468 or 409-938-0853.

'88 Mazda PU, 83k mi, good work truck, no A/C, missing grill, \$1.7k. Chuck, x36340 or 286-1470.

'84 Toyota Camry, 163k mi, runs great, no A/C,

\$1.4k. Chuck, x36340 or 286-1470.

'90 Jeep Cherokee, 4 dr, 5 spd, A/C, AM/FM, 64k mi, 1 owner, \$8k. 488-6798.

'89 Mazda CabPlus truck: B220 series, red w/charcoal int, auto, A/C, chrome wheels, AM/FM/cass, sliding back window, bedliner, new battery/tires, \$5.8k. 482-8820.

'66 Mustang, 289, 4 spd, dual exhaust, good cond, \$2.5k. 331-9255.

'88 Jeep Wrangler, 83k mi, 6 cyl, 5 spd, A/C, new soft top, ex cond, \$7.5k. 334-7143.

'92 Eagle Talon maroon, loaded, 5 spd, A/C, cruise, P/W, P/L, tilt, 70k mi, \$8k. Steve, 649-1396.

'94 Camaro, maroon, A/C, cruise, AM/FM/cass, 41k mi, \$9,750. x31443 or 997-8044.

'89 Plymouth Voyager LE minivan, 7 pass, A/C, overhead console, all pwr, AM/FM/cass, cruise/tilt, capt chairs, gray/wood grain, \$6.1k. x39152 or 333-2218.

'91 Ford Explorer XLT, 35k mi, V6, auto, pwr, tow-pkg, sunroof, 2 tone beige, leather int, 1 owner, ex cond, \$14,275. x46220 or 992-9419.

'88 Dodge Grand Caravan LE, V6, pwr, loaded, dual A/C, 1 owner, very clean, \$5,995 obo. 480-2507.

'88 Mazda 626 LX, loaded, moonroof, 5 spd, white ext/burgundy int, ex cond, 99k mi, \$4,750. Jeff, x41947 or 286-6785.

'84 Mazda RX-7 GSL-SE, black/red, 5 spd, sunroof, AM/FM/cass, A/C, P/W, good cond, \$2,950. 582-0415.

'89 Toyota Corolla SR5, special Limited Edition coupe, 2 dr, loaded, sunroof, CD changer, \$6.1k obo. 996-1861.

'93 Plymouth minivan, ex cond. 943-3685.

'87 Subaru GL Hatchback, A/C, AM/FM/cass, good tires, good cond, \$1,250. John, x32651 or 286-2432.

'94 Dodge Ram 250 Coachmen custom van, V8, auto, LWB, dual A/C & heat, dual radio, 4 capt chairs, sofa bed, pwr, TV conn, 28k mi, \$18.3k. Mark, 480-6262.

'87 Honda Accord LX, 4 dr, auto, A/C, P/W, cruise, stereo, \$4,950. 488-7771.

'88 Dodge aries wagon, 2.2L, 5spd, TBI, P/S, P/B, rear wiper & defrost, cruise, new clutch, A/C evap, waterpump, 7.9k mi, \$2.5k. Lane, 280-0437.

'91 Honda Civic DX, 4 dr, white ext/blue int, auto, 26k mi, ex cond, \$8.5k. Tracy, x45151.

Cycles

'86 Honda Magna 700cc, low mi, ex cond, \$2.5k. 488-6526.

'82 Harley Davidson FXR w/Evo engine, runs, needs some work. \$3.5k. 337-2190.

Boats & Planes

'87 Beneteau sailing sloop, 24' equipped for racing, 2 jibs, 2 spin, Johnson 9.9HP, VHF radio, depth, auto til, Loran, head, sleeps 4, \$14k. Ken, x31496 or 286-7583.

Sovereign, 24', ready to sail, main, jib, 125% genoa, depth sounder, head, stove, electric start Johnson OB, \$5.7k. Mike, 282-2787 or 286-1691.

'95 Polaris SL750 Watercraft w/trailer, 2 matching ski vests, under warr, ex cond, \$5.3k obo. 997-8338.

'87 Alumcraft 14.5', V-hull, Dilly trailer, '69 20HP Evinrude, troll motor, new battery, 2 pedestal

seats, \$1k. x39313 or 324-2840.

'92 Kaw 750 super sport jet ski, ex cond, \$3.5k. 488-5962.

'94 Sea Rayder Jet boat, 13.5', new 90HP Mer-cruiser motor, extra, \$7,750. 486-3954.

Dolphin Senior sailboat, 16', complete w/sail, built-in ice chest, trailer w/new tires, \$500 obo. Tom, x39040 or 332-6419.

Audiovisual & Computers

MFJ DSP filter model MFJ-784B, \$200. Ken, x38244 or 333-2636.

IBM compatible PC/XT/AT 640 KB RAM, 8 MHz, 20 MB HD, w/Magnavox color monitor & Axiom Daisy wheel printer, \$200; printer, Okidata-Okimate 20, black & color printing includes ribbons, \$40. x31057.

Mac Industrial SE computer, works, Image Writer I & continuous feed paper, \$300. 751-6248 or 333-1608.

Pentium 75 & 100, full warranty, \$1,699/\$1,899; 286 w/color monitor, \$225. Don, x38039 or 333-1751.

Mac SE computer, \$395. 488-7771.

540 MB, Western Digital HD, still under warranty, \$145. x35549 or 554-7104.

IBM XT compatible w/color monitor, \$100. x36228 or 409-848-1616.

Focus Ether Lan SC SCSI to Ethernet Macintosh adaptor, \$85. 480-3424.

Apple 2/c computer, monitor, key board, printer, games & educational disk, floppy drive only. 471-9399.

Apple 2/c computer, monitor, key board, printer, games & educational disk, floppy drive only. 471-9399.

Musical Instruments

Piano Estey console, good cond, \$400. 474-2214.

Sharp VCR/Camcorder combo, manuals, tripod, case \$250 obo. 282-3344 or 482-7603.

Minolta Maxima 35mm camera, 70-200mm zoom lens, auto focus, auto rewind, auto advance, flash, \$375. Pete. 479-0276.

Minolta Maxima 35mm camera, 70-200mm zoom lens, auto focus, auto rewind, auto advance, flash, \$375. Pete. 479-0276.

Pets & Livestock

Umbrella cockatoo, 7 yrs old, male, hand-fed, w/cage, \$750 or trade for piano or keyboards of comparable value. Larry, x47004 or Shirley, 930-8393.

Miniature Pinchers, reg, 8 wks old, 2 black & tan females, 1 red male, \$250 ea. Cheyenne, x31016 or 905-6330.

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King size bed & box, \$100; queen oak headboard, \$100; wooden swivel stools, 2, \$35 ea; gas dryer, \$100; chest freezer, \$50; 25" Zenith console TV, \$75; work bench, \$35. 534-3885.

Black sleeper sofa, qn, w/matching love seat, ex cond, \$800 both; matching framed prints 3 for \$100; victorian rose-on-white vine pattern wall paper, 9 unopened rolls, \$99. 482-8410.

Custom built bookcase & knick-nac shelf, \$125. Bill, 409-986-7138.

Oak book shelves, \$100; oak desk & bookshelf unite, \$140; heavy duty 5 drawer file cabinet, \$75. 482-1582.

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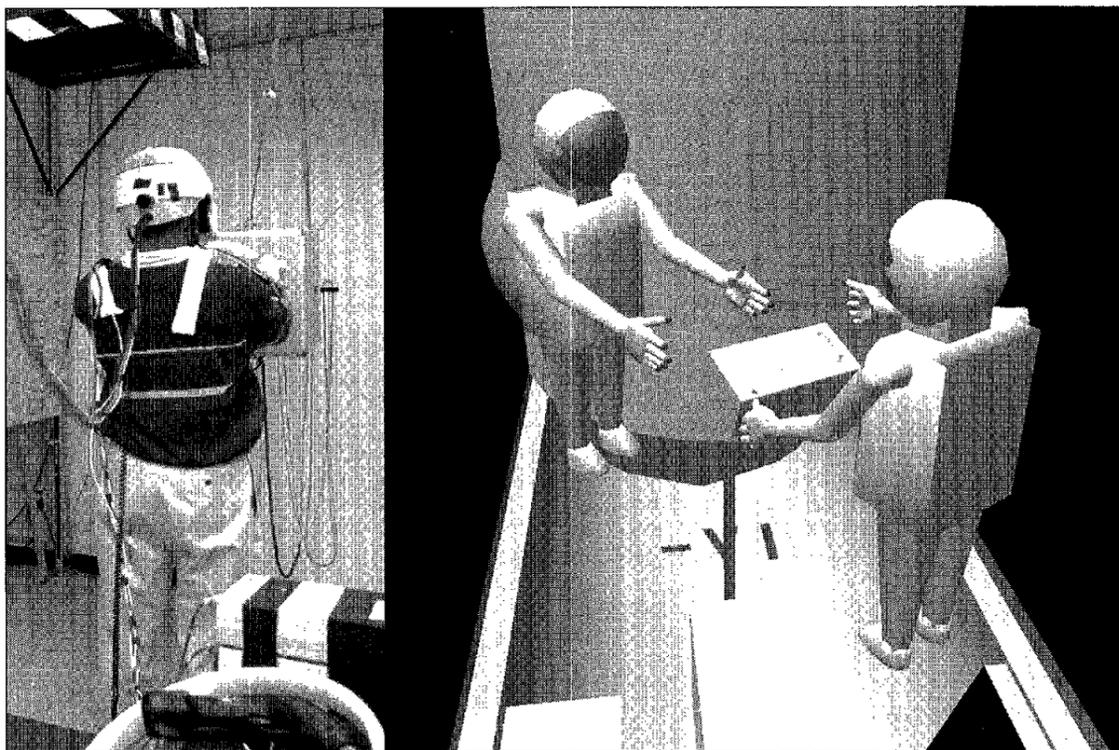
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Oak book



Long Distance Training

American, European astronauts train across an ocean via virtual reality

By Karen Schmidt

Astronauts, an ocean apart, are beginning to train together without having to leave their own countries.

As the space program moves into the International Space Station era, the task of training international crews has become a valid concern. With a variety of nations participating, training coordinators must consider not only language and cultural differences, but logistical and budgetary problems as well. For example flying crews back and forth across the Atlantic and Pacific to train together.

"The station will be consistently manned by teams comprised of astronauts from two or more partnering nations," said Frank Hughes, chief of the Space Flight Training Division. "As we come closer to training for the space station, we must consider the cost, in travel and physical wear."

Historically astronauts have been brought to JSC to undergo training. Not only do they receive generic training, but once selected for a mission they begin mission-specific training.

The Space Flight Training Division, in cooperation with the Office of Information Technology, has been exploring alternatives for training diverse crews.

In 1993, the Software Technology Branch team successfully trained more than 105 flight control team members in preparation for the servicing of the Hubble Space Telescope. Team members actively experienced simulated extravehicular activities that were planned for the mission. The primary goal was to familiarize the mission's ground-based support team—flight controllers, engineers and technicians—with the location, appearance and operability of the components on Hubble, as well as elements of the payload bay.

A survey after the mission verified that personnel benefited from the training. The ability to visualize tasks and positions had a positive affect on the team members' understanding of activities and objects.

"Since virtual reality had been used to train for the Hubble Space Telescope servicing mission, we asked Chris Culbert and his team to help come up with alternatives for future mis-

sions," Hughes said. "Virtual reality seemed a logical step in the progression of training."

A team was formed to develop a demonstration model for future training.

"Since we already had the Hubble models and understood those procedures we were able to use the work from that mission to speed up the development process of this project," said Bowen Loftin, principal investigator from the University of Houston. "We weren't starting from scratch and we saved time and money."

As work began on a model, the simulated exercise was developed. It was decided that a simple extravehicular activity simulation that engaged two astronauts, one at JSC and another in Europe, would be a good test.

Months of preparation culminated in a demonstration on Sept. 20, as Astronaut Bernard Harris entered a virtual environment with European Space Agency Astronaut Ulf Merbold. With Harris at JSC and Merbold at the Fraunhofer Institute for Computer Graphics in Darmstadt, Germany, the two astronauts shared an environment consisting of the shuttle payload bay and the Hubble Space Telescope.

They spent more than 30 minutes changing out Hubble's Solar Array Drive Electronics modules. The SADE task was simplified to grasping and transferring objects within the virtual environment. Doors, lids and protective casings were opened or lifted for the simulation. In the JSC environment, Harris wore a virtual reality glove, head-mounted display and sat in a hand-controller chair. His experience with hand controller-based devices helped in the success of the demonstration.

Harris was tasked to retrieve the new SADE located at the forward part of the orbiter's bay in a storage compartment called the Carrier Orbiter Replacement Unit. Harris then grasped the SADE object with his glove and used his hand controller chair to navigate to Merbold.

While Harris was working with the new SADE, Merbold began to remove the old SADE. Using parallel virtual reality manipulation and navigation hardware located in

Germany, Merbold grabbed the old SADE.

As Harris navigated from forward to aft in the shuttle bay, he also had to move up to where Merbold was waiting. All the while, each astronaut could literally view what the other was doing at any time, and communicate status at will. Body position and tracking were monitored from both sides of the Atlantic. Communication between the two astronaut was done by long-distance telephone hookup. Once Harris reached Merbold, exchanged their SADE devices.

Merbold remained at the Hubble site to install the new SADE into its berth while Harris navigated back to the carrier ORU to stow the old SADE.

After each astronaut had accomplished his SADE responsibilities, as a gesture of goodwill a second and last rendezvous ended in the virtual handshake and a wave good-bye.

This demonstration was accomplished by generating duplicate graphical environments at each site and exchanging state change data (for example, the movement of one astronaut's hand) via a commercial Integrated Services Digital Network line connecting the two sites.

NASA-developed software was used to render the graphics. Communications software developed by the Fraunhofer Institute for Computer Graphics was used for the exchange of state data.

Performance was judged acceptable by both astronauts, with round trip time delay of less than 200 milliseconds. Only about 20 percent of the available ISDN bandwidth was required. This suggests that inexpensive commercial channels could be used for this type of shared virtual environment and that at least three sites could be supported with the typical ISDN bandwidth.

After the demonstration both astronauts expressed strong support for this method of training. They also suggested using this system for cooperative task performance, procedure and timeline development.

"The demonstration was very successful,

verifying that virtual reality is a potential training tool for use across large distance," wrote Ellen Ochoa, lead of the Astronaut Analysis and Integration Team, in a letter to the three organizations involved. "This training will be most useful in the area of EVA proficiency training between station and shuttle crews."

While the demonstration went off without many problems, it took a talented team of individuals to get to this point.

In late 1994 the team was formed that included Loftin; Iliana Molina, Steve Potter, and Ken

Cofer of Rockwell who support the Space Flight Training Division; Culbert and Alice Aman of the Office of Information Technology; Robert Savely, chief scientist in the Information Systems Directorate; and Mark Voss and Tim Saito of LinCom Corporation.

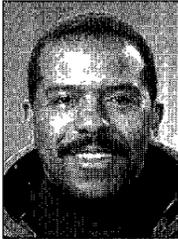
Loftin contacted the Fraunhofer Institute for

Computer Graphics in Germany. Professor Jose Encarnacao, and his virtual reality group directed by Martin Goebel worked with Wolfgang Felger, the project coordinator in Germany. They sent graduate student Torsten Froehlich from the Technical University of Darmstadt to JSC for three months to support the project. Other Institute members that served on the project team were Fan Dai, Dirk Reinert, Gabriel Zachman, Martin Bernhard, Norbert Schiffner, Mathias Gaertner, Wolfgang Puchler and Lu Zhang.

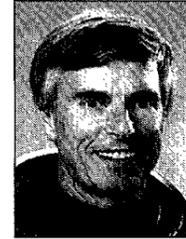
Most of the development centered on sharing these models and integrating two distinctly different virtual reality applications programs overseas. Communications protocols between the two programs had to be resolved with testing and some redesign by the German counterparts. In the meantime, network communications required technical research.

After the initial demonstration, both groups analyzed results and conducting additional experiments to better understand the networking and computer graphics issues that arose during development of the demonstration.

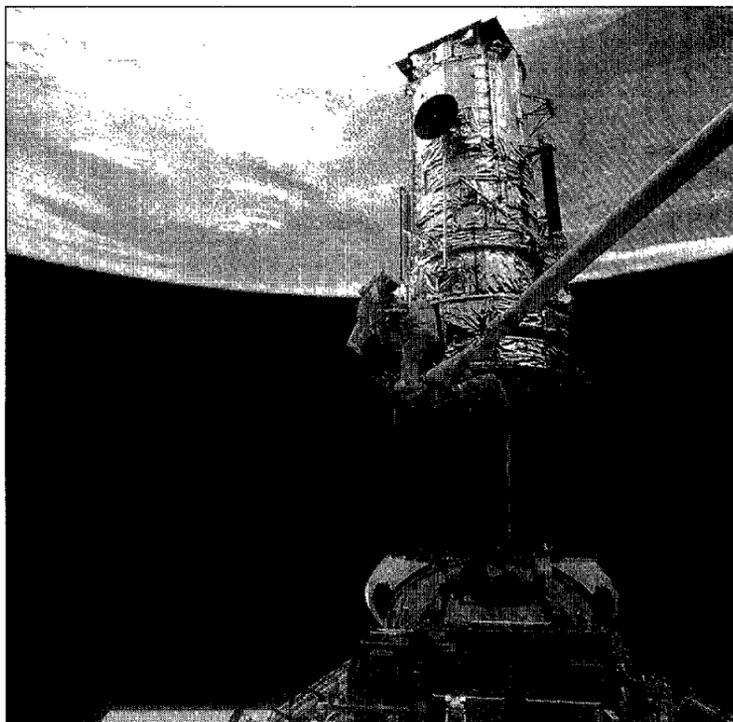
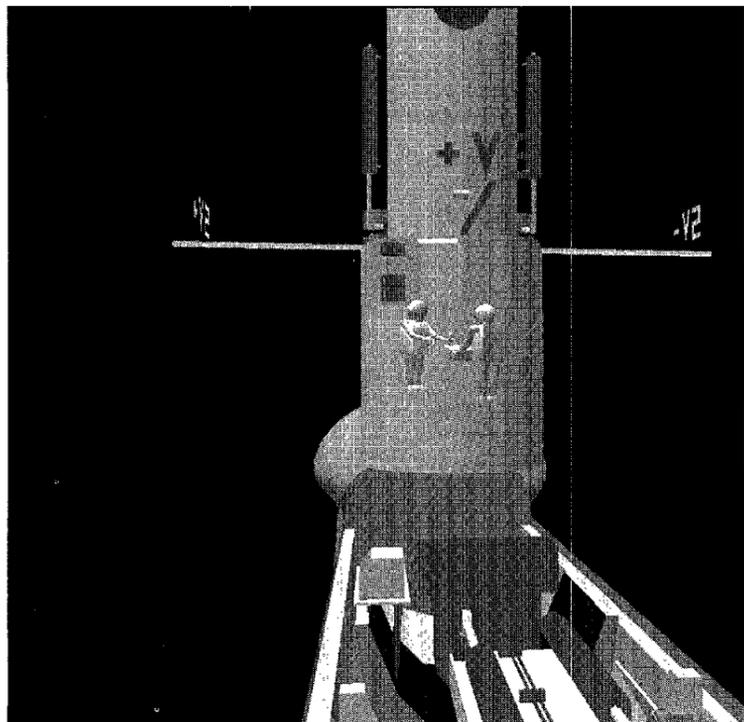
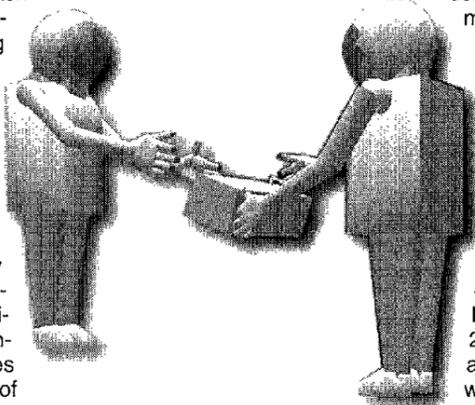
"Although we achieved a successful demonstration of capability—enough to elicit strong support from both astronauts—there remains much work to be done to make this a routine part of our training program," Loftin said. □



Harris



Merbold



Top: Astronaut Bernard Harris' experience with hand controller based devices helped the success of the long distance demonstration between JSC and Fraunhofer Institute for Computer Graphics in Darmstadt, Germany. Bottom: Harris and ESA Astronaut Ulf Merbold use identical maneuvers in virtual reality environment to replace a Solar Array Drive Electronics module as Jeff Hoffman and Story Musgrave, right, used during the servicing mission of the Hubble Space Telescope. Both team's work consisted of handing one another replacement SADE in exchange for the original SADE.

First 'snapshot' taken of shape of interplanetary magnetic field

NASA physicists using an instrument aboard the European Space Agency's Ulysses spacecraft have obtained the first instantaneous view, or "snapshot," of the spiral structure of our solar system's magnetic field.

These lines of magnetic force originate in the Sun and extend outward into the solar system. The "snapshot," assembled from observations of radio waves by a U.S.-French radio receiver on Ulysses, shows the spiral magnetic field extending from the Sun past the orbit of the planet Venus toward the orbit of Earth. Scientists used the unique vantage point of Ulysses above the pole of the Sun and the plane of the planets to obtain the image.

The method to obtain the image involved tracking the path of the bright spot of radio waves excited by moving electrons ejected from the Sun at speeds over 62,100 mph.

This spot was caused by solar flares or other explosive events on the Sun.

"As the electrons speed out into the solar system, they are constrained to follow the large scale magnetic field lines similar to the way cars are constrained to follow roads," said Joseph Fainberg, Goddard Space Flight Center scientist.

"The radio emissions, caused by the fast electrons moving through with the slower solar wind, allow us to trace out the magnetic lines of force much like you might deduce the course of a road at night from an airplane by tracking the headlights of individual cars," said Michael Reiner, chief scientist at Hughes STX Co. "A chart of the received radio emissions shows that they follow the expected spiral shape, even including the kinks due to variations in solar wind speed. At these high speeds, the whole path takes about 20 min-

utes to Earth's orbit."

Previous radio observations made by space probes orbiting in or near the plane of the Earth's orbit did not provide a good vantage point for observing the spiral shape of the magnetic field. Observations in space are required because the radio frequencies of the solar wind do not get through the Earth's ionosphere.

"It was like trying to determine the shape of our Milky Way galaxy from our location inside," explains Robert Stone, a senior scientist at Goddard's Laboratory for Extraterrestrial Physics. "We could get fine photos of individual stars and star clusters, but no perspective on the whole system. What we needed was the equivalent of an aerial photo of our Milky Way galaxy."

"The aerial photo of the interplanetary magnetic field became possible with the flight of

Ulysses over the south pole of the Sun in 1994," said Reiner. "Now we could look down on the solar system, and these radio observations made by Ulysses gave us the first direct observation of the spiral structure in space between the Sun and the Earth."

The radio receiver on board Ulysses used to make the new "snapshot" was developed in a cooperative effort with experts at the Paris Observatory in France, the University of Minnesota in Minneapolis, and Goddard.

Ulysses was launched in October 1990. The spacecraft's course led it to the planet Jupiter, where in February 1992, it received a gravitational assist from the huge planet that sent it out of the plane of the Earth's orbit and eventually over the poles of the Sun. After passing over the south pole in October 1994, Ulysses continued on a trajectory that recently took it over the Sun's north pole.

Cold weather brings out frisky deer

JSC's security officers perform a wide range of duties to safeguard JSC employees on site.

During early morning and dusk, those duties also may include acting as "traffic cop" for the herds of deer that graze on the open lands throughout the campus. The deer cross heavily traveled Avenue B to move from their shelter among the trees to the open grazing areas.

"This time of year is particularly bad," said Joel Walker, chief of the Support Operations Branch. "The cool weather makes the deer active during a peak rush hour. We have posted security vehicles with flashing lights, and now barrels with flashing lights to try and get drivers to slow down and be attentive in this area."

Security officers patrol, driving slowly along the roadside. When they spot deer near the road, the officers will turn on the warning lights on their vehicles to alert drivers.

Walker said employees should be alert to the variety of wildlife living on site, and should show some extra caution driving whenever they see one of the security vehicles or barrels with flashing lights.

NASA'S budget still uncertain

NASA's budget bill has passed both the House and the Senate, but it is now up to a conference committee to resolve the differences between the two versions.

Committee meetings are expected to begin next week. Once reconciled, the bill will go back to both houses for a vote, and then on to the White House, where a veto is a possibility. Meanwhile, the government continues to operate under the continuing resolution passed in October. Although this resolution will expire Nov. 13, agencies are "cautiously optimistic" that the threat of furlough will be avoided. It is generally expected that in the absence of an approved budget, an extension of the continuing resolution will be passed in order to keep the government running smoothly.



SPACE EXPLORATION '95—STS-71 Commander Hoot Gibson addresses a full house during a luncheon conducted during the Space Exploration '95 conference held last week at Space Center Houston. Conference highlights included reusable launch vehicles, space station highlights, technology transfer and tours of the Sonny Carter Training Facility and the new Mission Control.

JSC Photo by Andrew Patnesky

New miniature sensor system developed

A team led by NASA researchers has devised a miniaturized sensor system that could begin a new generation of small, low-cost spacecraft to explore the solar system.

The Planetary Integrated Camera-Spectrometer, or PICS, is expected to replace whole suites of individual instruments that, on some missions, can weigh more than 400 pounds and take up as much room as a four-drawer filing cabinet. Literally smaller than a breadbox, PICS combines some of the most productive and often-used space sensors into an 11-pound package.

Its development represents a crucial step toward enabling future missions that will have to use smaller launch vehicles and, hence, smaller spacecraft to travel to distant planets and other bodies in the solar system.

In addition to being much smaller, the PICS system offers high performance and improved instrument sensitivity over previous spacecraft instruments of the same type at lower overall cost, according to PICS Program Manager Gregg Vane of the Jet Propulsion Laboratory. "Many people assume that low cost implies low capability," he said, "but

PICS proves you can have very high capability at low cost."

The PICS prototype, developed through a collaboration between JPL, industry, universities and the U.S. Geological Survey, recently completed successful tests that qualify the instrument for development as flight hardware. PICS is a candidate for flight on several future planetary spacecraft missions.

PICS is one of the first successful efforts to squeeze down multiple instrument optics, functions and electronics into a small, efficient unit that requires less power and mass. It brings together in one integrated sensor system an ultraviolet imaging spectrometer, an infrared imaging spectrometer and two visible-light cameras—instruments that can characterize the chemical makeup, thermal properties, weather, atmospheric physics and geophysics of bodies in the solar system.

In the past, each of these spacecraft instruments has been built with its own separate, dedicated optical system and electronics. In PICS, the instruments share common telescope optics and extremely low-power, miniaturized instrument elec-

tronics. The result is one highly capable integrated instrument that requires less than five watts of power and is so small it can be tucked under an arm. In comparison, similar instruments on the Voyager spacecraft required 75 watts to operate four large, entirely separate sensors, in addition to a sophisticated pointable scan platform for aiming.

"PICS will be able to achieve Voyager-class science at 10 cents on the dollar," said geologist Larry Soderblom of the U.S. Geological Survey in Flagstaff, Ariz. "PICS will allow the science return we are accustomed to from our flagship missions like Voyager, but at the cost of a Discovery mission—about 1/10th to 1/20th of the cost."

PICS' initial development was triggered by a challenge from designers of the Pluto Express mission, a proposed exploration of the only known planet in the solar system that still awaits close reconnaissance by a spacecraft. The Pluto mission's requirements called for an instrument incorporating two spectrometers—one far ultraviolet and one infrared—in addition to two visible-light cameras, all weighing in at less

than about 15 pounds. Space instrument specialists say no previously existing instrument met these constraints or even came close to matching those specifications.

From the outset, the PICS team's approach was to simplify the system and to minimize the mass and power of the instruments by maximizing the extent to which components can be shared. To further reduce mass and power consumption, PICS was designed to eliminate items such as focusing mechanisms and filter wheels found on traditional spacecraft imaging systems.

Another critical innovation in the PICS design was the decision to construct all the optical and structural components of silicon carbide. The material is inexpensive, highly dimensionally stable, chemically non-reactive and possesses excellent structural capabilities and manufacturability, according to Vane.

Fully prototyped and tested, PICS has been designed for ease of manufacture, integration and test. A flight model for a candidate mission could be produced in 18 months.

"We're ready to roll," Beauchamp said. "We're just waiting for a ride."



total health

Total Health party set for next week

JSC will celebrate the third annual "Pond Party" from 10 a.m.-2 p.m. Thursday to mark the anniversary of the Total Health employee wellness program.

This event brings together representatives of all aspects of the Total Health Program and provides an opportunity for employees to ask questions of the experts from the Environmental Health Lab, Industrial Hygiene, and the JSC Clinic and Laboratory. Tables will be set up in four buildings and at different locations around the JSC mall duck ponds.

Total Health regulars and other experts in the areas of ergonomics, stress reduction, civil service benefits, emergency preparedness, safety, and cancer screening and awareness will be on hand. Blood sugar testing also will be provided by registered medical technologists from the JSC Clinic lab.

Total Health is designed to help employees make lifestyle choices that will keep them health and productive in a safe environment. Employees are invited to join in "for the health of it." For more information call Lynn Hogan at x37790.

Lasers will assist in Mir docking

(Continued from Page 1)

grab the docking module out of the back of the payload bay, bring it around and install it vertically so it's sticking up on top of the shuttle. That will provide us with the tunnel so that we can leave from the middeck of the shuttle and float up through this tunnel and eventually into Mir." Hadfield will berth the module on Atlantis' orbiter docking system, which is mounted within the payload bay.

Once the module and the docking system are connected, Ross will conduct pressure checks and reestablish electrical connections. After testing, hatches will be open to prepare the module for docking.

Once the module is in place, Cameron will perform several orbiter maneuvers to place Atlantis within

docking distance of Mir. Cameron noted that the STS-74 crew learned a lot from STS-71. Cameras, lighting and crew coordination have been enhanced in talks with STS-71 crew members.

"We will be approaching Mir from underneath," McArthur said. "We will rise up to join with Mir. It is a very controlled approach as we saw on STS-71. There will be a couple of points during the approach where we will stop and assess our alignment. Chris and I will use the hand-held lasers in conjunction with the payload bay lasers. We will put the data into laptops and envision how our approach to Mir is going."

An on-time launch would have Atlantis returning on Nov. 19 to KSC at about 12:28 p.m. CST.

Space News Roundup

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Editor Kelly Humphries
Associate Editor Karen Schmidt

Crew grows edible food in orbit

(Continued from Page 1)

plants have appeared very healthy thus far.

"This is the first time that crop plants have been grown to produce edible food in space," said Astroculture co-investigator Theodore Tibbitts.

Yet another experiment has studied the behavior of the Sun by imitating the flow patterns its liquid surface may have. The Geophysical Fluid Flow Cell already has provided new insight.

"This is new and exciting stuff ... we've seen some surprising turbulence," John Hart told crew members. "We are comparing these results with our computer simulations and other theoretical ideas to understand the extensive turbulence which starts

near the Sun's polar regions and spreads rapidly toward the equator."

Columbia has remained flying in a gravity gradient attitude, a naturally stable orientation that minimizes steering jet firings which could disturb the sensitive experiments and conserves fuel. Periodically during the mission, however, the crew has maneuvered the spacecraft to an orientation that points the underside toward the Sun, allowing the landing gear tires to stay within desired temperature ranges. Each warming period has lasted about 14 hours. In addition, the left-hand payload bay door has remained partially closed during the majority of the flight to help protect the radiator and coolant lines along its interior from orbital debris.